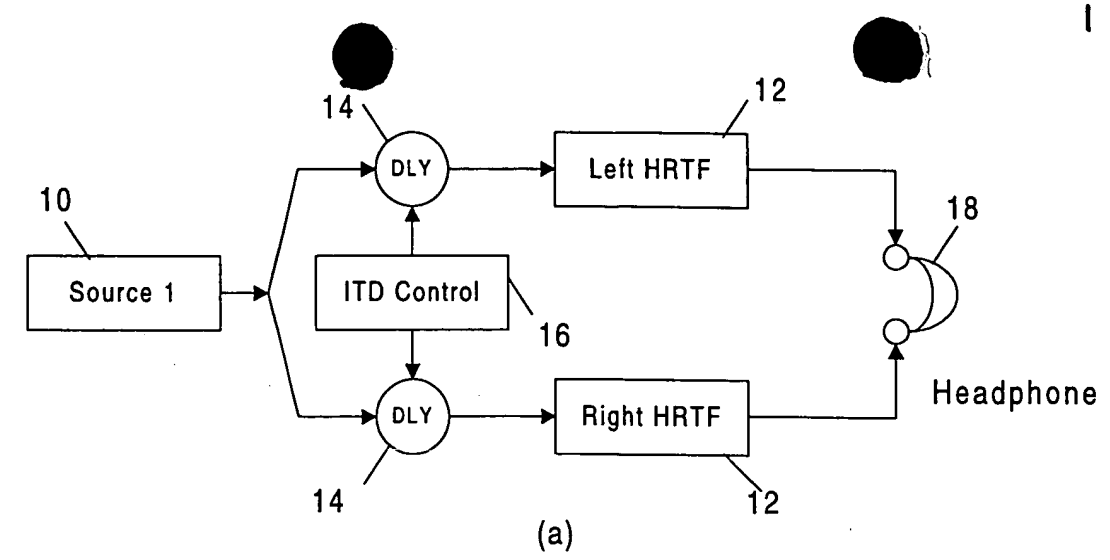
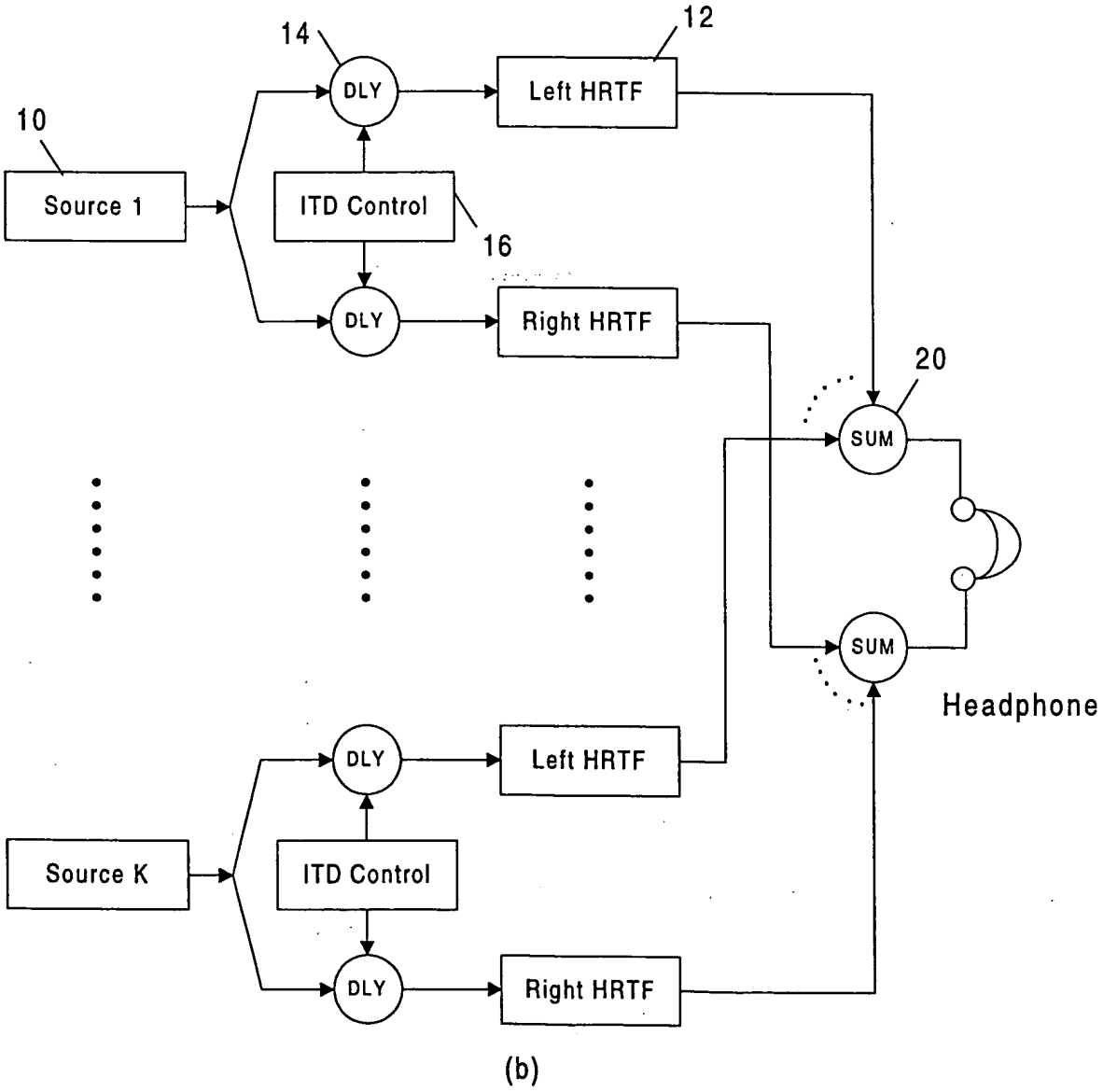


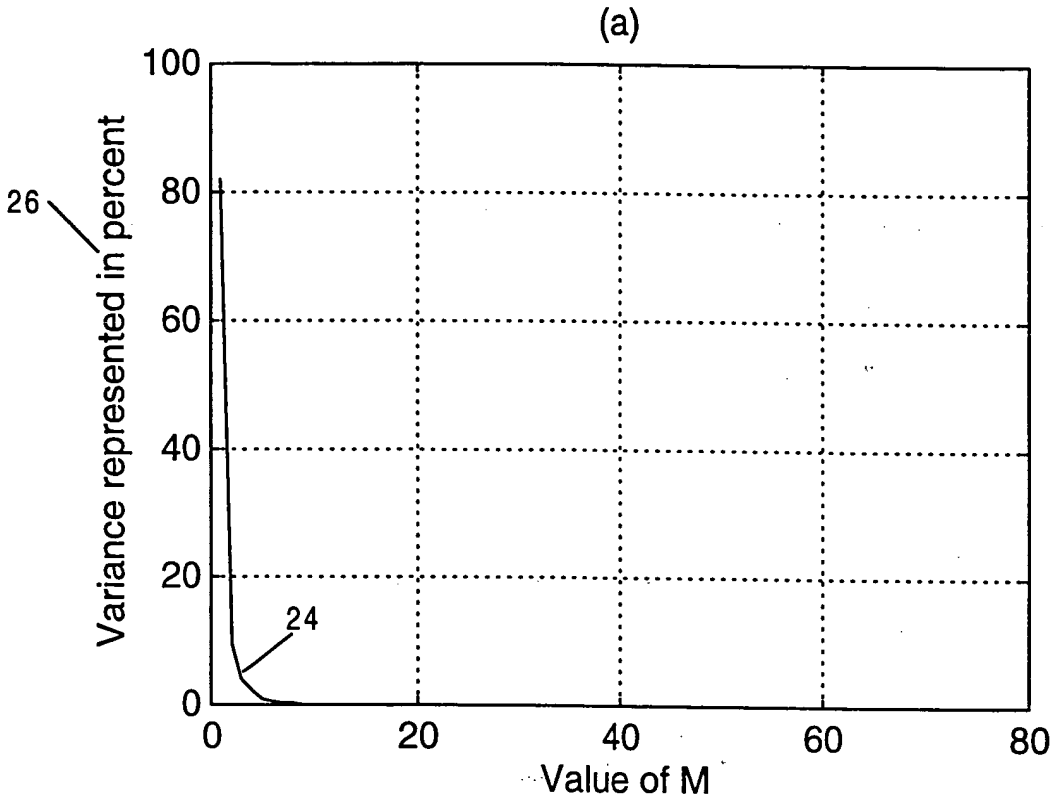
(a)



(b)

Figure 1. 3D sound source positioning by direct convolution.
(a) Single source case. (b) Multiple source case.

Sony Exhibit 1008
Sony v. Personalized Media
IPR2020-00958


(a)
Variance represented in percent
26
24
100
80
60
40
20
0
0
20
40
60
80
Value of M

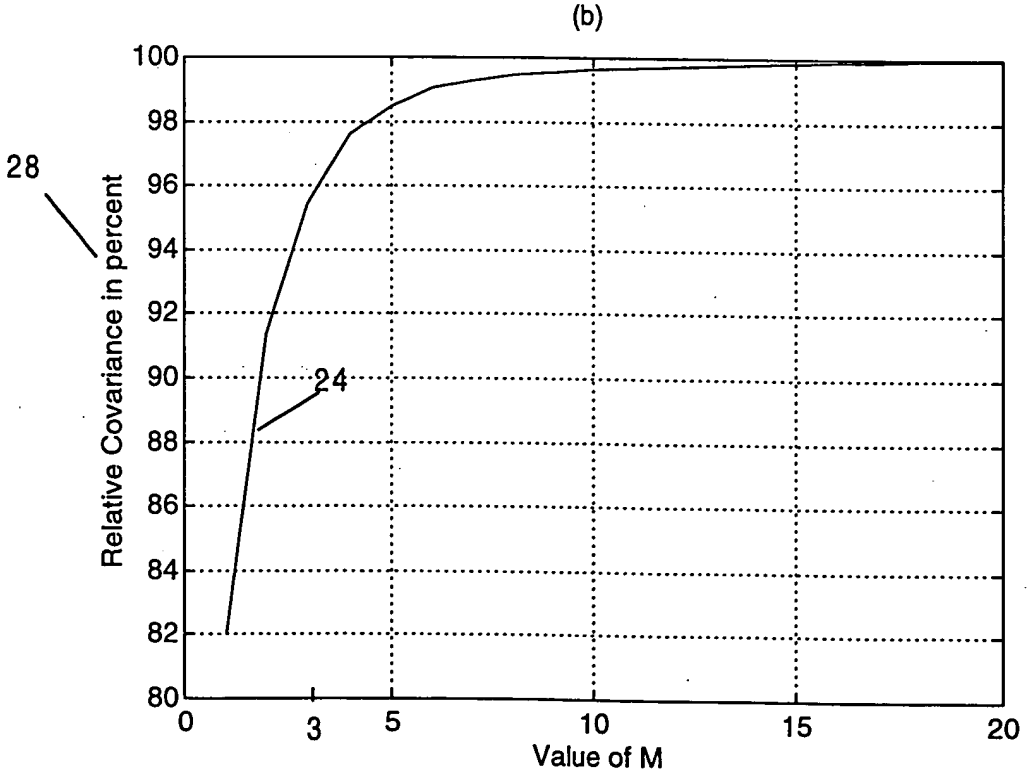

(b)
Relative Covariance in percent
28
24
100
98
96
94
92
90
88
86
84
82
80
0
3
5
10
15
20
Value of M

Figure 2

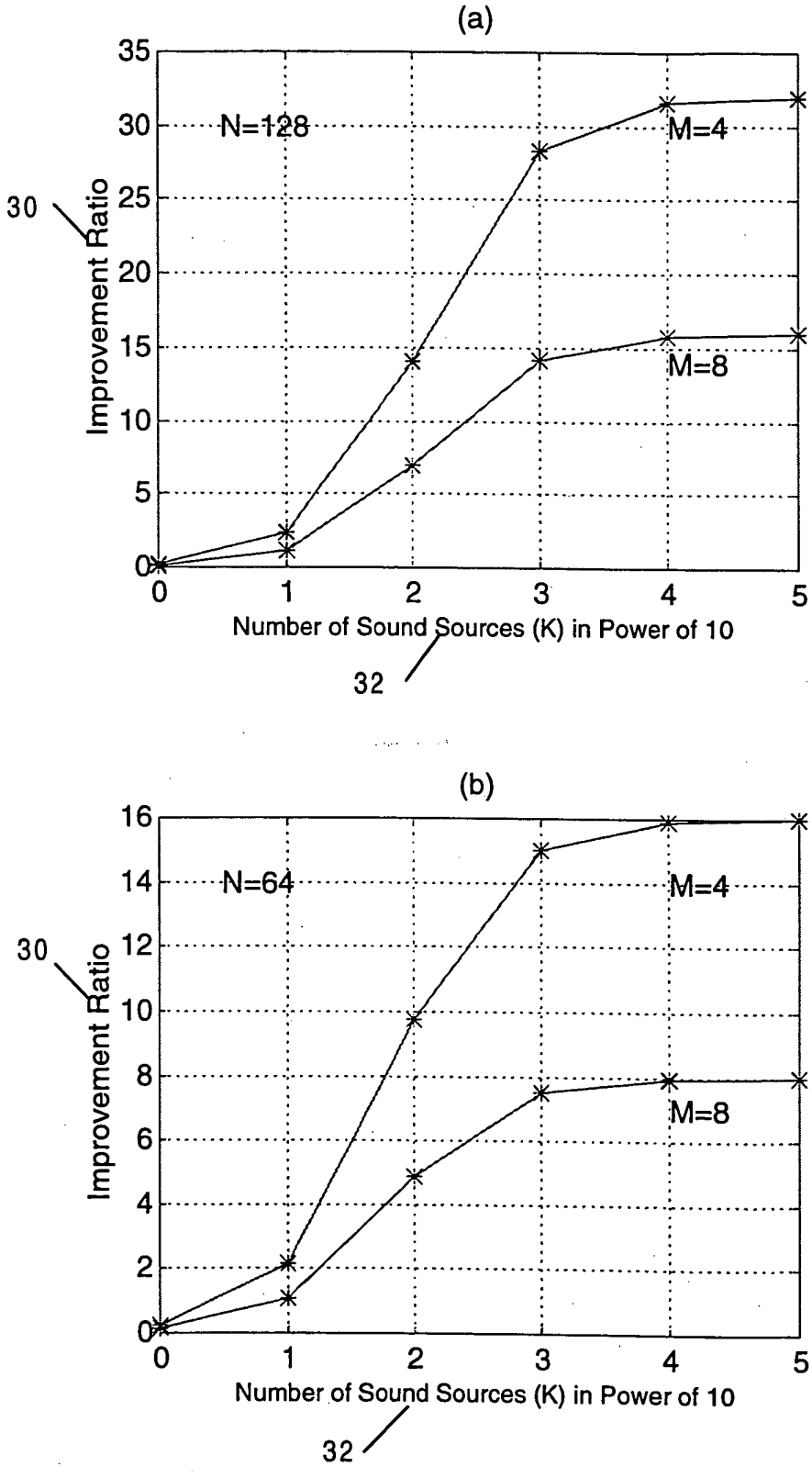

(a)
N=128
M=4
M=8
Improvement Ratio
30
Number of Sound Sources (K) in Power of 10
32
(b)
N=64
M=4
M=8
Improvement Ratio
30
Number of Sound Sources (K) in Power of 10
32

Figure 3

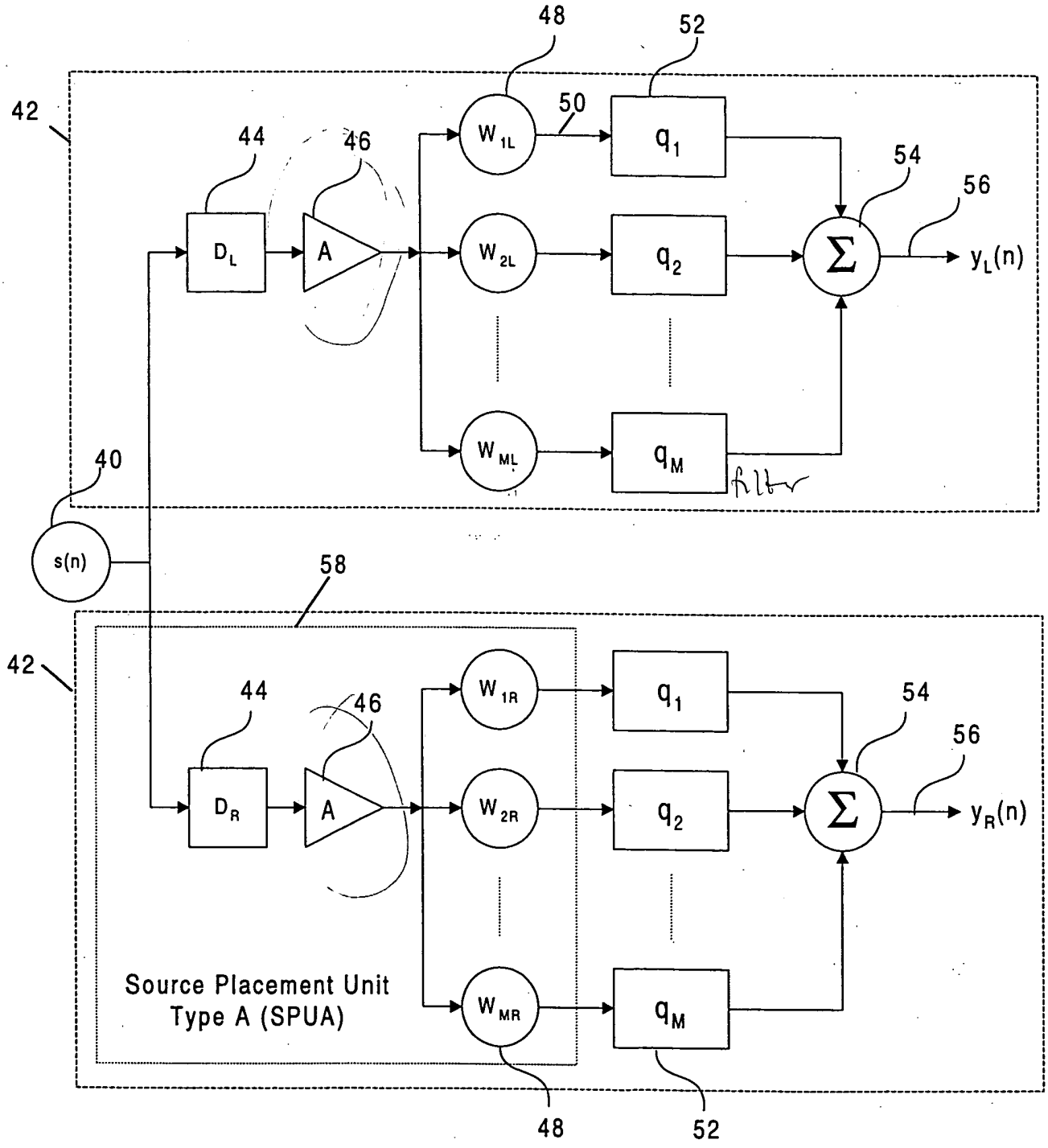

42
44
46
48
50
52
54
56
D_L
A
W_{1L}
W_{2L}
W_{ML}
q_1
q_2
q_M
Σ
$y_L(n)$
40
s(n)
58
42
44
46
D_R
A
W_{1R}
W_{2R}
W_{MR}
q_1
q_2
q_M
54
56
Σ
$y_R(n)$
Source Placement Unit
Type A (SPUA)
48
52

Figure 4 (a)

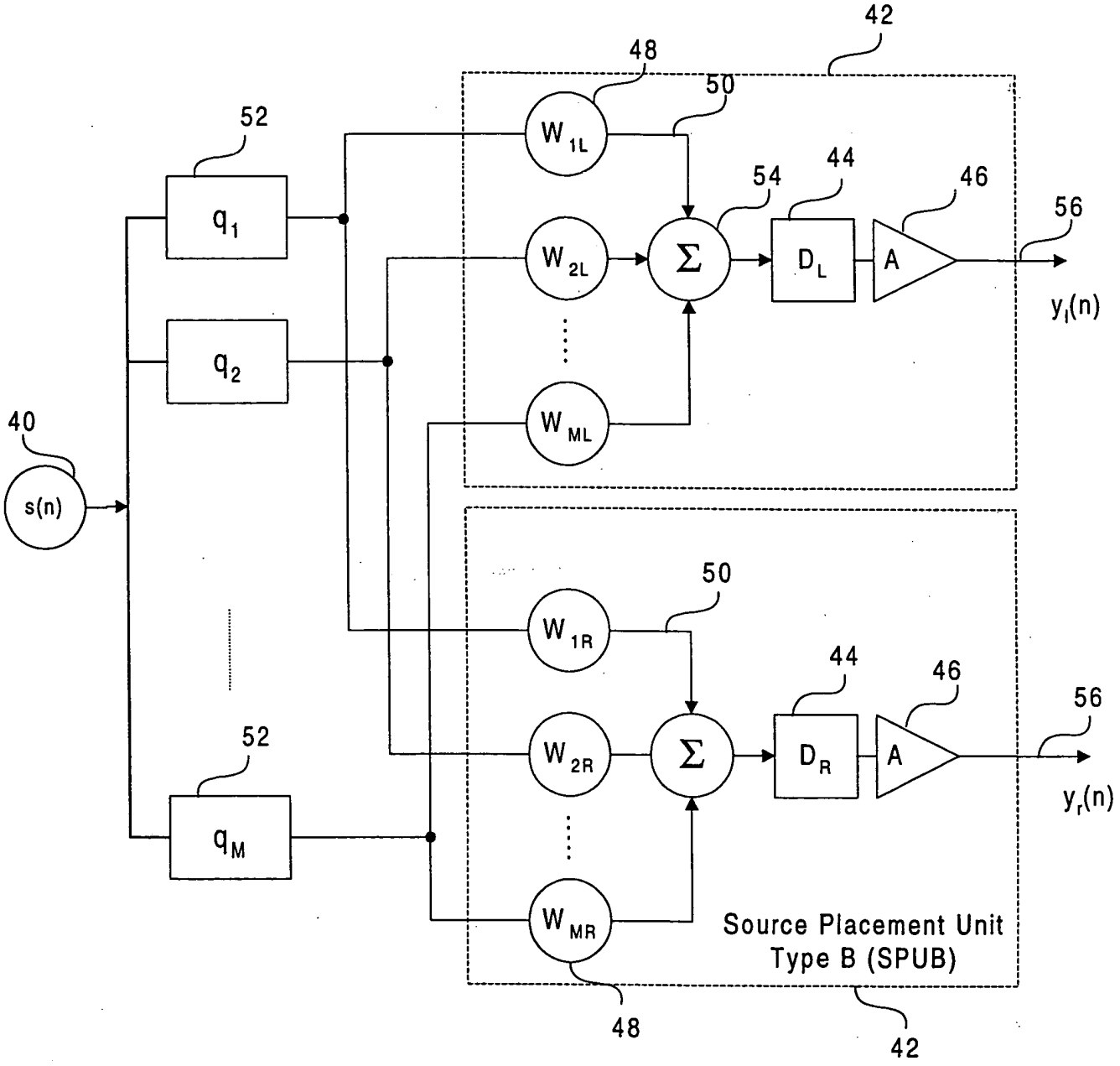

42
48
50
52
W_{1L}
q_1
54
44
46
56
W_{2L}
Σ
D_L
A
$y_l(n)$
q_2
W_{ML}
40
s(n)
50
W_{1R}
44
46
56
52
W_{2R}
Σ
D_R
A
$y_r(n)$
q_M
W_{MR}
Source Placement Unit
Type B (SPUB)
48
42

Figure 4 (b)

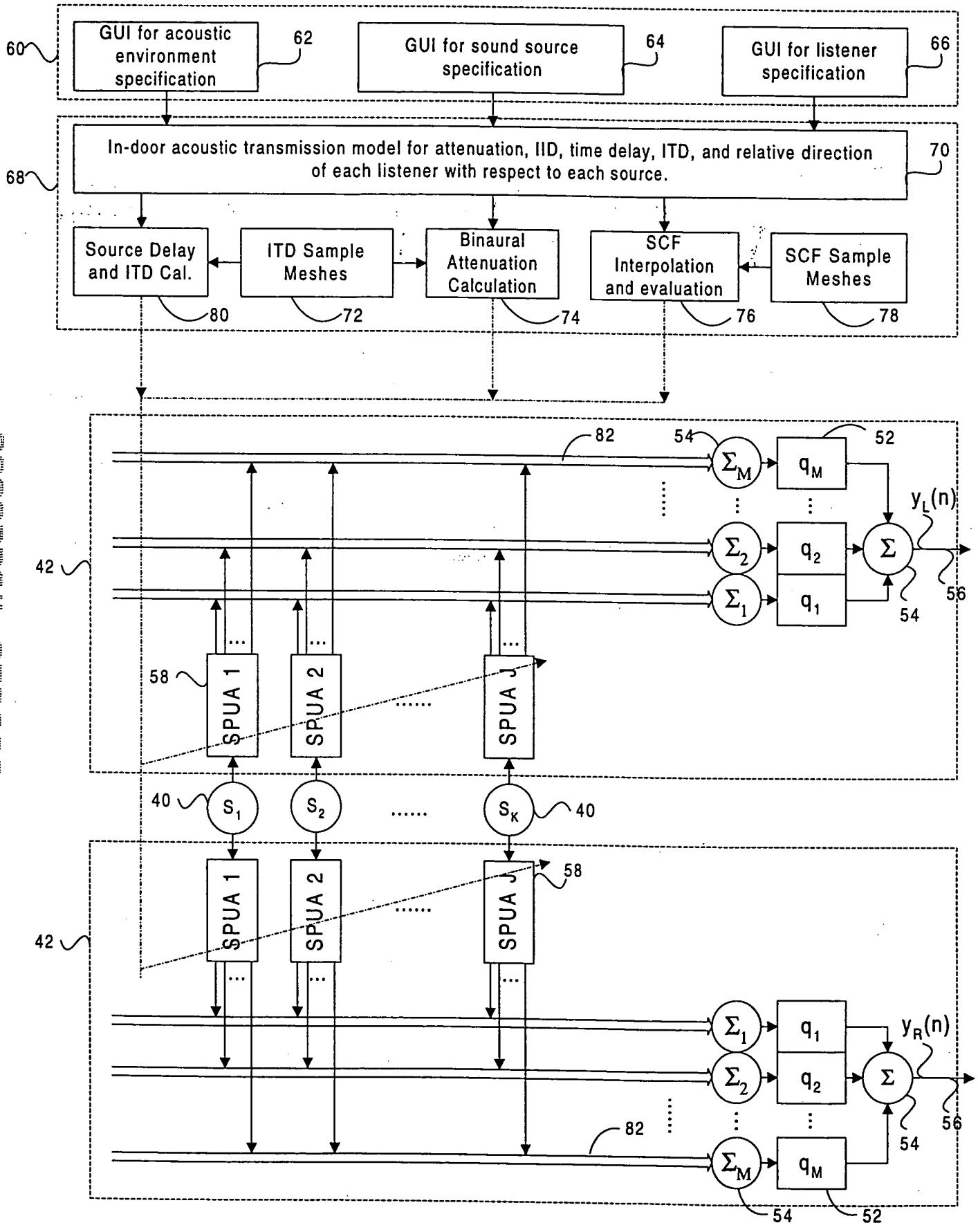

60
GUI for acoustic environment specification
62
GUI for sound source specification
64
GUI for listener specification
66
68
In-door acoustic transmission model for attenuation, IID, time delay, ITD, and relative direction of each listener with respect to each source.
70
Source Delay and ITD Cal.
80
ITD Sample Meshes
72
Binaural Attenuation Calculation
74
SCF Interpolation and evaluation
76
SCF Sample Meshes
78
42
82
54
52
Σ_M
q_M
Σ_2
q_2
Σ_1
q_1
Σ
$y_L(n)$
56
58
SPUA 1
SPUA 2
SPUA J
40
S_1
S_2
S_K
$y_R(n)$

Figure 5

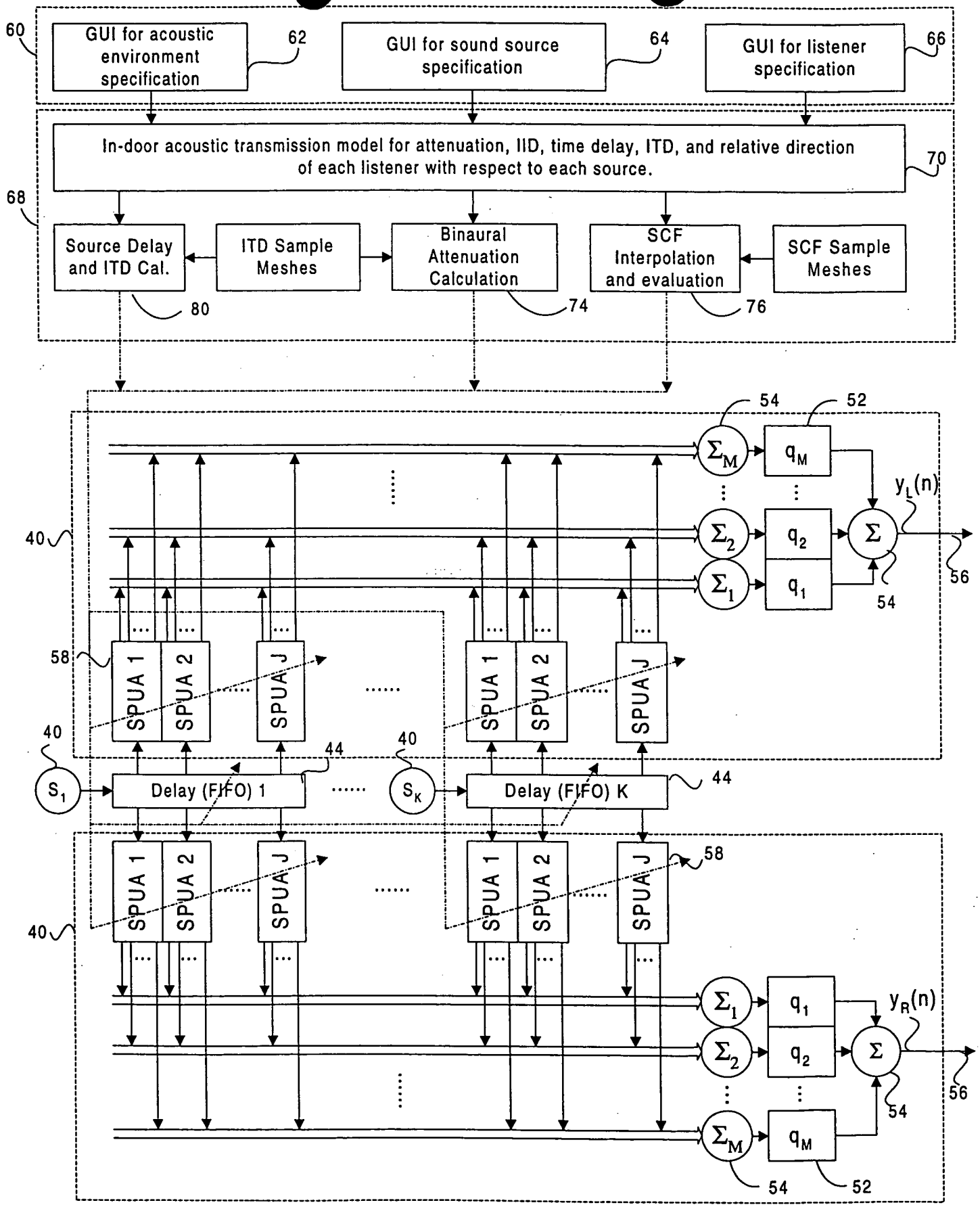

60
GUI for acoustic environment specification
62
GUI for sound source specification
64
GUI for listener specification
66
In-door acoustic transmission model for attenuation, IID, time delay, ITD, and relative direction of each listener with respect to each source.
70
68
Source Delay and ITD Cal.
ITD Sample Meshes
Binaural Attenuation Calculation
SCF Interpolation and evaluation
SCF Sample Meshes
80
74
76
54
52
40
58
SPUA 1
SPUA 2
SPUA J
44
Delay (FIFO) 1
Delay (FIFO) K
56

Figure 6

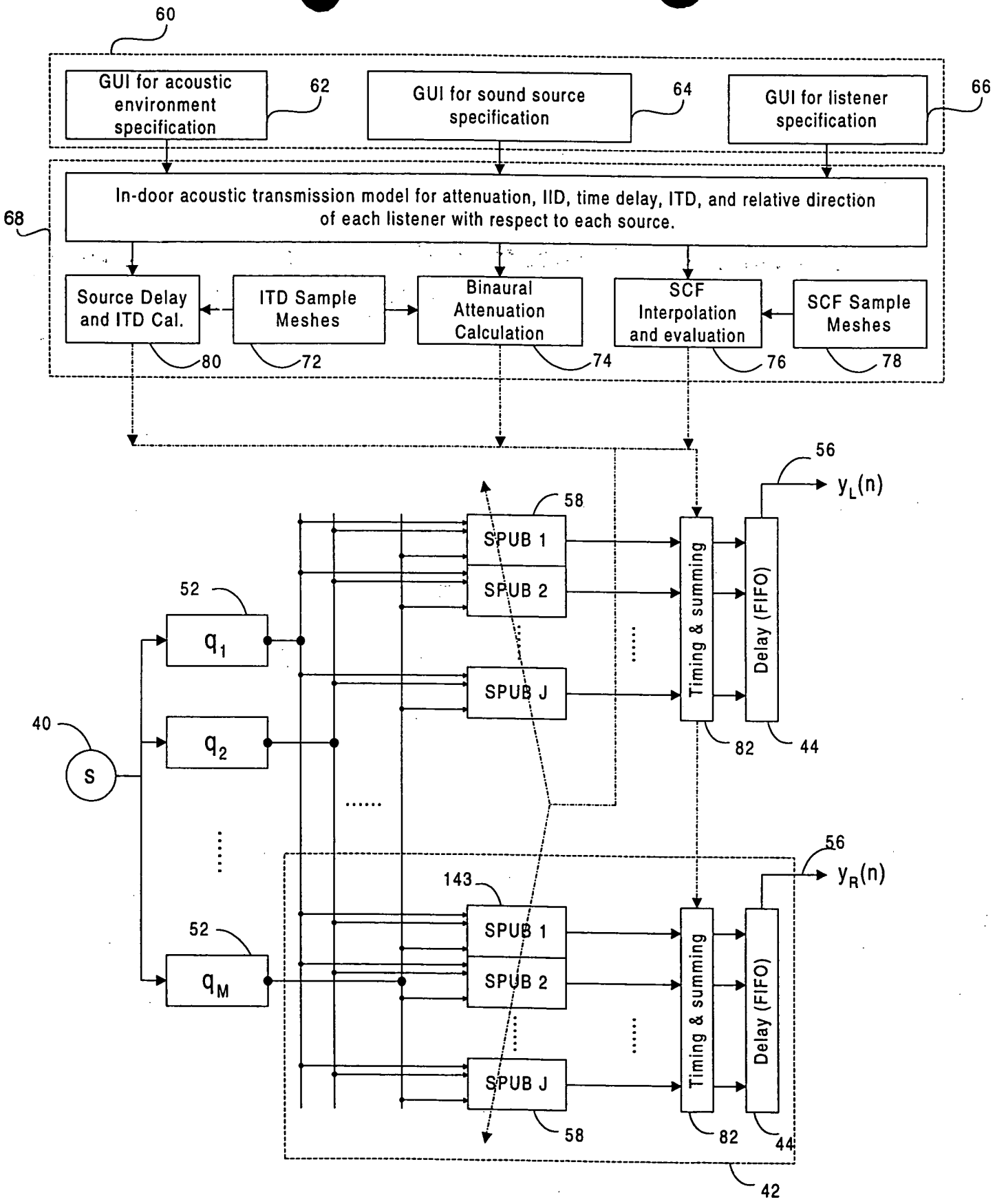

60
GUI for acoustic environment specification
62
GUI for sound source specification
64
GUI for listener specification
66
68
In-door acoustic transmission model for attenuation, IID, time delay, ITD, and relative direction of each listener with respect to each source.
Source Delay and ITD Cal.
ITD Sample Meshes
Binaural Attenuation Calculation
SCF Interpolation and evaluation
SCF Sample Meshes
80
72
74
76
78
56
$y_L(n)$
58
SPUB 1
SPUB 2
SPUB J
52
q_1
q_2
q_M
40
S
Timing & summing
Delay (FIFO)
82
44
143
56
$y_R(n)$
42

Figure 7